Access to Chemotherapy Services by Availability of Local and Visiting Oncologists

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Abstract

Purpose: Geographic disparities have raised important questions about factors related to treatment choice and travel time, which can affect access to cancer care.

Patients and Methods: Iowa residents who received chemotherapy regardless of where they were diagnosed or treated were identified through the Iowa Cancer Registry (ICR), a member of the SEER program. Oncologists and their practice locations, including visiting consulting clinics (VCCs), were tracked through the Iowa Physician Information System. Oncologists, VCCs, and patients were mapped to hospital service areas (HSAs).

Results: Between 2004 and 2010, 113,885 newly diagnosed invasive cancers were entered into ICR; among patients in whom these cancers were diagnosed, 31.6% received chemotherapy

as a first course of treatment. During this period, 106 Iowa oncologists practiced in 14 cities, and 82 engaged in outreach to 85 VCCs in 77 rural communities. Of patients receiving chemotherapy, 63.0% resided in an HSA that had a local oncologist and traveled 21 minutes for treatment on average. In contrast, 29.3% of patients receiving chemotherapy resided in an HSA with a VCC, and 7.7% resided in an HSA with no oncology provider. These latter two groups of patients traveled 58 minutes on average to receive chemotherapy. Availability of oncologists and VCCs affected where patients received chemotherapy. The establishment of VCCs increased access to oncologists in rural communities and increased the rate that chemotherapy was administered in rural communities from 10% to 24%, a notable increase in local access.

Conclusion: Access to cancer care is dependent on the absolute number of providers, but it is also dependent on their geographic distribution.

Introduction

Adequacy of the oncology workforce has been a source of growing concern¹ and may be compounded by inequities in the geographic distribution of oncologists. The importance of this is borne out in studies showing that decreased access to specialized cancer care has been associated with greater risk of presenting with advanced cancer, receiving less optimal treatment, and increased mortality.²⁻⁴ Access to cancer care has been measured by the supply of oncologists per population of 100,000, by rate of delivery of various treatment options, and by patients' wait and travel times to receive cancer treatment.²⁻⁴ Geographic disparities have been identified for each of these outcomes, and these studies have raised important questions about factors related to treatment choice and travel time that require further study to clearly assess access to cancer care.²⁻⁴ To examine these questions, our analyses use a statewide comprehensive cancer registry to identify patients with cancer who received chemotherapy and a unique statewide tracking system to identify all oncologists and their practice locations, including specialty outreach clinics.

Patients and Methods

The Iowa Cancer Registry (ICR)⁵ participates in the National Cancer Institute SEER program,⁶ which currently represents

28% of the US population and is widely used to track cancer incidence, prevalence, and survival. ICR strives to capture all newly diagnosed cancers among Iowa residents, regardless of where they are diagnosed or treated. Between 2004 and 2010, ICR provided facility records from 113,885 invasive cancer diagnoses in Iowa residents. ICR records location of diagnosis, where the known first course of treatment (which may include multiple treatment types) was provided, and whether it included chemotherapy. Physicians in Iowa are tracked continuously through the Iowa Physician Information System (IPIS),⁷ which records physicians' self-identified specialty and certification, plus practice locations, including visiting consulting clinics (VCCs).^{8,9} Patient residence was classified as urban or rural based on the rural-urban commuting area (RUCA) code associated with the patient's zip code at time of diagnosis. RUCA codes¹⁰ are based on census tract population and commuting data. Using the approach described by the Washington, Wyoming, Alaska, Montana, and Idaho Rural Health Research Center,¹¹ zip codes were assigned to one of four geographic classifications: urban, large rural, small rural, and isolated rural. Patient and facility locations were also classified by hospital service area (HSA),¹² obtained from the Dartmouth Atlas of Health Care, which created a system to identify hospital local area markets. For each US hospital, the HSA identifies a geo-

Table 1. Distribution of Where Iowa Patients Receiving Chemotherapy Live and Where They Get Treated, 2004 to 2010

Patients Receiving Chemotherapy	Cancers		HSA Treatment (%)		Median Travel Time to Chosen Facility (minutes)
	No.	%	Within	Outside	
Living in HSA with oncologist	22,513	63.0	72.6	27.4	21.0
Living in HSA with no oncologist but with VCC	10,462	29.3	24.2	75.8	58.0
Living in HSA with no oncologist or VCC	2,770	7.7	10.3	89.7	59.0

Abbreviations: HSA, hospital service area; VCC, visiting consulting clinic.

graphically contiguous region of zip codes within which Medicare residents are most likely to receive care at that hospital.¹² Distances in miles and minutes were computed from the locations of the centroids of the 920 Iowa zip codes where patients with cancer resided to the locations where chemotherapy was administered through a commercially available distance function that used the network description of the Iowa road network with its typical speed limits for each road segment. Maps of these distances were made using the location coordinates of each zip code and the spatial interpolation function in ArcGIS software (Esri, Redlands, CA). Analysis of ICR data for this study was approved by the University of Iowa Institutional Review Board.

Results

Of the 113,885 newly diagnosed invasive cancers in ICR from 2004 to 2010, 13,977 (12.3%) were not treated with a first course therapy,¹³ and 99,908 (87.7%) were treated with some therapy. Of the total cancers, 35,991 (31.6%) were treated with chemotherapy as part of the first course of treatment. The 35,745 cancers treated with chemotherapy at an identifiable treatment location formed the basis for these analyses.

Supply and Location of Oncologists in Iowa

Between 2004 and 2010, IPIS identified 106 oncologists (including hematologists, medical and gynecologic oncologists, and pediatric hematologists/oncologists, but excluding radiation oncologists) with practice locations in Iowa. The primary practice locations of most oncologists were in the nine largest cities in Iowa.

As is typical nationally, specialists in Iowa were almost exclusively based in urban centers or large rural communities. Specialist outreach is one approach to increasing access to rural locations.^{14,15} The arrangement is through established contracts and schedules,^{8,9} usually exclusive between one host organization and one sponsoring organization.¹⁶ IPIS data indicated contracted consulting arrangements (known as VCCs) originating from 15 hubs and serving 77 rural communities through 85 individual clinics operating between 2004 and 2010. The frequency of visits by oncologists was greatest for once per month (45%), followed by two to three times per month (28%), once per week (18%), and more than once per week (9%). Visiting oncologists primarily provided diagnostic services at the VCCs.

Data on HSAs were analyzed to identify local area markets for all Iowa and bordering hospitals. Between 2004 and 2010, there were 94 hospital markets centered in Iowa, but Iowa patients with cancer during this period received initial treatment and/or recom-

mendations in 104 health care markets, 10 of which were in neighboring states. For each patient receiving chemotherapy, the facilities in his or her HSA were identified. Likewise, for each oncologist practice and for each VCC, the HSA was identified.

As summarized in Table 1, of the 35,745 patients who received chemotherapy during initial treatment, 22,513 (63.0%) resided in an HSA that had a local oncologist. Of the remaining 13,232 patients (37.0%) who resided in an HSA that did not have a local oncologist, 10,462 (79.1%) resided in an HSA with at least one institution sponsoring a VCC, and 2,770 (20.9%) resided in an HSA with no oncology service.

Also listed in Table 1 is the percentage of patients who received chemotherapy in their HSA or outside their HSA. For patients living in an HSA with a local oncologist, 72.6% received chemotherapy at a facility in their HSA, and 27.4% traveled outside their HSA for chemotherapy. The opposite pattern was evident for patients living in an HSA with no oncologist but with a VCC (24.2% and 75.8%, respectively). Almost all patients (89.7%) living in an HSA with no oncologist or VCC traveled outside their HSA for chemotherapy. The percentage of patients receiving chemotherapy for their cancer in facilities near their home was only 10.3% if no oncologist was available locally, but it increased to 24.2% if an oncologist VCC was present. Those patients living in an HSA with a local oncologist traveled a median of 21.0 minutes to the treating institution, whereas those in an HSA with no oncologist traveled a median of 58.0 minutes. As listed in Table 1, patients living in an HSA without a local oncologist traveled virtually the same distance to receive chemotherapy if there was a VCC in their HSA as those living in an HSA with no oncologist services.

Of the chemotherapy patients living in an HSA with no local oncologist but with a VCC, 47.6% received chemotherapy at the location of the VCC sponsor, but 52.4% did so at some other facility. Of those who did not receive chemotherapy at the VCC oncologist's sponsor facility, 50.4% received chemotherapy at a closer location, 11.2% at a facility within 5 miles of the sponsor facility, and 38.4% at a more distant facility location. The characteristics of patients receiving chemotherapy are listed in Table 2.

Travel Distance to Chemotherapy Treatment Facilities

Access to chemotherapy was examined by identifying the residence at time of cancer diagnosis of all patients receiving chemotherapy, the location where they received treatment (chosen facility), and the location of the closest chemotherapy facility (nearest available facility). The mean travel time was 47.8 minutes and the median travel time was 31.0 minutes to the chosen

Table 2. Characteristics of Patients Who Received Chemotherapy

Characteristic	Overall No. of Patients (N = 35,745)	HSA With Oncologist		HSA With VCC Only		HSA With No Oncologist or VCC	
		No. of Patients (n = 22,513)	Received Chemotherapy in HSA (%)	No. of Patients (n = 10,462)	Received Chemotherapy in HSA (%)	No. of Patients (n = 2,770)	Received Chemotherapy in HSA (%)
Disease site							
Brain/CNS	837	557	56.55	228	10.09	52	—*
Breast	5,866	3,857	82.73	1,600	34.94	409	15.16
Colon	2,697	1,607	77.72	888	40.54	202	19.31
Rectum	1,824	1,149	75.20	537	23.28	138	12.32
Other digestive	3,653	2,302	61.25	1,060	17.55	291	11.00
Endocrine	75	51	50.98	20	5.00	—*	—*
Female genitalia	2,072	1,312	53.35	584	16.78	176	9.09
Leukemia	1,544	947	64.63	467	19.49	130	7.69
Lung	7,273	4,647	79.64	2,105	17.81	521	7.10
Other respiratory	327	210	61.43	97	13.40	20	—*
Lymphoma	3,812	2,358	74.22	1,128	27.39	326	8.59
Myeloma	853	514	76.07	256	21.88	83	—*
Oral cavity/pharynx	875	587	62.18	225	15.56	63	—*
Prostate	89	50	64.00	33	15.15	—*	—*
Other male genitalia	239	166	74.10	55	16.36	18	—*
Skin	153	90	73.33	50	38.00	13	—*
Soft tissue	181	118	44.92	46	10.87	17	—*
Urinary system	1,997	1,181	70.53	625	20.64	191	9.95
Other	1,378	810	67.16	458	28.60	110	—*
Stage							
I	4,914	3,802	75.18	1,449	26.78	383	8.09
II	6,163	3,998	75.86	1,720	27.50	445	11.24
III	8,225	5,218	73.53	2,357	25.33	650	12.15
IV	10,072	6,307	72.40	3,002	20.95	763	9.83
Unknown	6,371	3,908	66.56	1,934	22.85	529	9.45
Sex							
Male	16,719	10,377	70.31	5,018	21.32	1,324	9.21
Female	19,024	12,134	74.64	5,444	26.80	1,446	11.27
Age, years							
< 18	573	389	38.05	135	5.93	49	—*
18-65	19,601	12,873	70.98	5,341	21.33	1,387	9.81
> 65	15,571	9,251	76.41	4,986	27.72	1,334	11.09

Abbreviations: HSA, hospital service area; VCC, visiting consulting clinic.

* Fewer than 10 patient cases.

chemotherapy treatment facility. In contrast, the time to the nearest available facility was considerably less (mean, 13.8 minutes; median, 11.0 minutes). One quarter of the population had a treatment facility within 22 minutes but instead traveled more than 1 hour to receive chemotherapy.

The map in Figure 1 shows the times that Iowa residents traveled to receive chemotherapy. As can be seen in the map, there was considerable variability, with residents of certain areas traveling much longer than residents of other areas. We conducted bivariable and multivariable linear regression analyses and found that all patient characteristics were significantly re-

lated to driving time, including diagnosis year (significant in bivariable analysis only), disease site, stage, age category, sex, patient residence category, presence of an oncologist in the HSA, presence of a VCC in the HSA, and treatment at an institution with an oncologist (Appendix Table A1, online only). In particular, driving time increased with cancer stage and decreased with age category. Because pediatric patients (age < 18 years) tend to seek care in specialized centers, of which there are only two in Iowa, pediatric patients with cancer had significantly lengthier travel times, although their limited number did not affect the overall median or mean travel time.

Figure 1. Travel time (minutes) to chosen chemotherapy facilities by Iowa residents newly diagnosed with cancer from 2004 to 2010.

Similarly, the estimated 8% of Iowa patients who participated in clinical trials¹⁷ likely traveled farther. Another notable pattern was related to patient residence; patients residing in isolated rural communities drove 3× longer than patients residing in urban communities. As expected, presence of an oncologist in the HSA was related to shorter driving times.

Discussion

Adequacy of the physician workforce has been a source of growing concern, and there are particular issues related to the geographic distribution of primary care physicians and medical specialists. Opinions about this subject vary, but the majority opinion holds that although the supply of physicians in the United States is growing, there is and will continue to be a shortage of physicians in many areas. In particular, the American Society of Clinical Oncology projected a significant shortage of oncologists to meet the demands of treating growing aging and cancer survivor populations in the United States.¹ In addition, rural and remote areas, inner cities, and financially challenged areas have long experienced greater shortages than more prosperous communities. This geographic distribution means that access to oncologist services is restricted for many patients with cancer. Our analyses demonstrate this point in that oncologist practices are based in only 14 cities in Iowa. Half of the Iowa population resides in cities that have local access to oncologists. However, for the other half of the state population who reside in rural areas, visiting one of these oncologists often involves considerable travel. Moreover, 69% of Iowa oncologists are located in just three cities; eight cities host practices of two to six oncologists; the remaining three cities are particularly vulnerable, because they are served by a single oncologist.

Specialist outreach models exist worldwide in various formats to provide better access to underserved populations. One model establishes specialist clinics in rural settings where there is no resident specialist.¹⁵ The limited research on this outreach model has shown improved access, outcomes, and service use.¹⁵ This model is the type of specialist outreach developed throughout rural Iowa and many other states. VCCs usually have a set schedule and are staffed by either a single specialist consultant

or a rotation of specialist consultants from an urban-based group practice. Most commonly, the services involve a limited range of nonemergent diagnostic, consultative, and therapeutic interventions.⁹ It has been shown previously that the motive for establishing VCCs in rural communities is primarily a strategic response of specialists to increased competition in urban areas.¹⁸ Demonstrating this motivating factor, a survey in Massachusetts found that “supplementing their patient base and income were the most important reasons visiting specialists reported for initiating an ancillary clinic.”^{19(p294)} VCCs are closely tracked in Iowa, and nearly all are organized by groups of private medical specialists with the expectation of adding new volume to the specialists’ practice through outreach services. Another common reason for the VCCs is to protect existing market share from going to a competing group that might enter the rural market and offer the same service.¹⁵

VCCs can affect where rural patients with cancer receive treatment through two opposing business channels. The first channel is one that draws patients to the local rural facility by bringing a visiting specialist’s services to patients seen there. A related channel is one that enriches the services offered by the local primary care providers through active consultation with a visiting specialist or indirect influences over time through contact with a VCC. The alternative channel is one that draws patients away from the local facility toward the visiting specialist’s sponsoring organization. VCC surgeons, for example, increase performance of less complex procedures at rural hospitals and likewise refer patients with more complex cases to their home facility.

The effects of these varying business models are demonstrated in our analyses, which showed that the percentage of patients receiving chemotherapy in facilities near their home was 72.6% if an oncologist had a local practice and only 10.3% if no oncologist was available locally, but this increased to 24.2% if an oncologist VCC was established. These findings indicate that access to chemotherapy locally is more than doubled in rural communities hosting VCCs. Although this increase is substantial, it is likely limited, because most oncologists in VCCs primarily provide diagnostic and consultation services rather than treatment. The absolute percent of patients who receive chemotherapy in communities without a resident oncologist remained low. For all patients receiving chemotherapy, the median travel time nearly tripled for those residing in an HSA with either a VCC, or no oncologist or VCC, compared with those residing in an HSA with an oncologist (58.0 and 59.0 minutes, respectively, compared with 21.0 minutes).

We then hypothesized that oncologists engaged as VCCs in rural communities would preferentially attract patients to their own home facility. Surprisingly, in HSAs with no resident oncologist but with a VCC, 47.6% of patients who traveled to receive chemotherapy did so at the location of the VCC sponsor facility, but 52.4% did so at some other facility. Of those who did not receive chemotherapy at the VCC oncologist’s sponsor facility, 50.4% received chemotherapy at a closer location, 11.2% at a facility near the sponsor facility, and 38.4% at a

more distant location. Thus, oncology VCCs seem to increase the rate at which chemotherapy is delivered locally in rural facilities. Whether they establish some preference for rural patients to receive chemotherapy at the VCC-sponsoring urban facility is less clear. Our exploratory analyses were able to partially examine these patterns, but future research would require more specific data on factors affecting choices patients make relative to available treatment options.

The findings presented here must be qualified in terms of several limitations. In particular, because physicians are not exhaustively coded in ICR, we cannot definitively state whether a patient saw a visiting oncologist. What we can say is that the patient received chemotherapy at a facility that did or did not have a local oncologist or VCC contract. Furthermore, because of confidentiality safeguards in ICR, the location of providers cannot be divulged. Another limitation was potential underreporting of chemotherapy by oncologists and nononcologists and lack of detailed information on type of chemotherapy administered, which precluded understanding the nature of treatment provided at institutions without oncologist oversight. Also, the nonwhite population of Iowa is smaller than that at the national level, and because of patient identity issues, race/ethnic group could not be examined. Likewise, insurance status was not available in ICR. Both race/ethnic group and insurance coverage have been linked to access issues. Moreover, insurance coverage can play a role in selection of treatment facility, a factor we could not explore.

A strength of our study was the use of a comprehensive cancer registry, which permitted chemotherapy treatment to be explored across a recent timeframe. Moreover, a particular strength was the use of a unique database of all providers and facilities, which permitted the location of treatment options involving both local oncologists and specialty outreach arrangements to be examined. The population distribution in Iowa is nearly evenly split between rural and urban populations (53.4% urban and 46.6% rural¹¹ using RUCA codes¹⁰), which facilitated examination of this important variable. Our analyses add substantially to the only two US studies we could find that examined oncology outreach services to underserved rural areas. One study showed minimal effect on rural-urban differences in breast cancer management after an intensive educational intervention in rural Illinois.²⁰ In contrast, a second study of a rural cancer outreach program in Virginia showed reduced cost, largely through more use of outpatient services, more efficient use of resources, and a shift to a less expensive venue for care.²¹

National estimates indicate that the median supply of oncologists is 2.83 per 100,000 residents.⁴ Our data indicate that Iowa has 3.48 oncologists per 100,000 residents. Thus, the overall supply of oncologists is favorable in Iowa. However, an equally important factor is where those oncologists practice. Factoring in VCC arrangements along with local practice settings is imperative for understanding access issues.⁹

Our analyses elucidate a number of factors affecting access to chemotherapy. The most important factors are obviously the number of patients with cancer and the supply of oncologists. Added to these is the distribution of patients and providers. Certain segments of the population of patients with cancer, namely those residing in rural areas, have less choice, must travel farther to receive chemotherapy than urban patients, and are more vulnerable if a VCC arrangement ends or a nearby practice closes. Our data show that patients with cancer living outside large cities travel 1 hour on average for chemotherapy—3× longer than their urban counterparts. Through unique data available in Iowa, we have shown that VCCs help to fill the gap. However, their effect is mixed—the low rate of local treatment doubles, but most patients with cancer outside large cities still travel to urban sites for treatment. Our findings are generalizable to much of the United States, where the distribution of oncologists and functioning of VCCs is much like that in Iowa. Our study of these factors affecting access can help practicing oncologists guide their patients to better understand available treatment options.

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Authors' Disclosures of Potential Conflicts of Interest

The author(s) indicated no potential conflicts of interest.

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Appendix

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Table A1. Driving Time to Chemotherapy Administration

Variable	No. of Patients	Mean Time (minutes)	Median Time (minutes)	Bivariable <i>P</i>	Multivariable <i>P</i>
Year				< .003	.2
2004	4,751	46.1	31.0		
2005	4,929	46.9	31.0		
2006	5,069	47.6	30.0		
2007	5,322	47.8	31.0		
2008	5,260	47.9	32.0		
2009	5,257	49.5	33.0		
2010	5,157	48.3	32.0		
Disease site				< .001	< .001
Breast	5,866	35.2	23.0		
Colon	2,697	38.1	25.0		
Other male genitalia	239	44.1	25.0		
Lung	7,273	44.2	30.0		
Rectum	1,824	45.3	30.0		
Lymphoma	3,812	47.3	31.0		
Skin	153	52.5	31.5		
Urinary system	1,997	5.0	34.0		
Other	1,378	55.0	34.0		
Myeloma	853	49.7	35.0		
Leukemia	1,544	51.4	39.0		
Other digestive	3,653	61.1	41.0		
Oral cavity/pharynx	875	55.1	41.0		
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Brain/CNS	837	65.9	50.0		
Female genitalia	2,072	61.2	52.0		
Soft tissue	181	72.7	57.0		
Endocrine	75	77.5	76.0		
Stage				< .001	< .001
I	4,914	43.0	28.0		
II	6,163	43.7	27.0		
III	8,225	46.4	30.0		
IV	10,072	50.4	34.0		
Unknown	6,371	53.0	37.0		
Age, years				< .001	< .001
< 18	573	72.1	63.0		
18-65	19,601	49.5	32.0		
> 65	15,571	44.7	30.0		
Sex				< .001	< .001
Male	16,719	50.8	35.0		
Female	19,024	45.1	29.0		
Residence				< .001	< .001
Urban	17,592	31.3	19.0		
Large rural city/town	5,387	53.8	38.0		
Small rural town	6,536	63.8	57.0		
Isolated small rural town	6,227	72.3	60.0		